



TransGrid

Summary: Maintaining compliance with performance standards applicable to Liverpool substation secondary systems

RIT-T Project Assessment Conclusions Report

Region: Greater Sydney

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Summary

TransGrid is applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining reliable secondary systems at Liverpool substation. Publication of this Project Assessment Conclusions Report (PACR) represents the final step in the RIT-T process.

Liverpool substation will continue to play a central role in the safe and reliable operation of the power system throughout and after the transition to a low-carbon electricity future. Located in Liverpool, one of the fastest growing regions in Sydney, Liverpool substation is a customer connection point supplying the Endeavour Energy 132 kV network within the South Western Sydney area and forms part of TransGrid's Greater Sydney network.

TransGrid has identified that the secondary systems at Liverpool substation have reached a condition that reflects the end of serviceable life. As it is superseded by new technology at the manufacturer level and the existing technology becomes obsolete, spare parts become scarce and the ability of any primary asset connected to the substation to reliably operate will be at risk.

Identified need: meet the service level required under the National Electricity Rules for protection schemes

Secondary systems are used to control, monitor, protect and secure communication to facilitate safe and reliable network operation.¹ They are necessary to operate the transmission network and prevent damage to primary assets when adverse events occur.

Provision of redundant protection schemes to ensure the transmission system is adequately protected is a Network Performance Requirement under Schedule 5.1 of the National Electricity Rules (NER), therefore the condition issues affecting the secondary systems at Liverpool substation must be addressed.

The Network Performance Requirements, set out in Schedule 5.1 of the NER, place an obligation on Transmission Network Service Providers (TNSPs) to provide redundant protection schemes to ensure the transmission system is adequately protected. Schedule 5.1.9(c) of the NER requires a TNSP to provide sufficient primary and back-up protection systems, including any communications facilities and breaker fail protection systems, to ensure that a fault of any type anywhere on its transmission system is automatically disconnected.

Additionally, TNSPs are required to disconnect the unprotected primary systems where secondary systems fault lasts for more than eight hours (for planned maintenance) or 24 hours (for unplanned outages). TNSPs must also ensure that all protection systems for lines at a voltage above 66 kV are well-maintained so as to be available at all times other than for short periods (less than eight hours), while the maintenance of protection systems is being carried out.² In the event of an unplanned outage, AEMO's Power System Security Guidelines require that the primary network assets must be taken out of service within 24 hours.³

Furthermore, as per clause 4.11.1 of the NER, remote monitoring and control systems are required to be maintained in accordance with the standards and protocols determined and advised by AEMO. A failure of the secondary systems would involve replacement of the failed component or taking the affected primary assets, such as lines and transformers, out of service.

¹ As per Schedule 5.1 of the NER.

² As per S5.1.2.1(d) of the NER.

³ Australian Energy Market Operator. "Power System Security Guidelines, 7 April 2021." Melbourne: Australian Energy Market Operator, 2021.35. Accessed 22 June 2021. https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3715-power-system-security-guidelines.pdf?la=en

Though replacement of failed secondary systems component is a possible interim measure, the approach is not sustainable as the stock of spare components will deplete due to the technology no longer being manufactured or supported. Once all spares are used, replacement will cease to be a viable option to meet performance standards stipulated in clause 4.6.1 of the NER.

If the failure to provide functional secondary systems due to technology obsolescence is not addressed by a technically and commercially feasible credible option in sufficient time (by 2022/23), the likelihood of not recovering from secondary systems faults and not maintaining compliance with NER performance requirements will increase.

The proposed investment will enable TransGrid to continue to meet the standards for secondary systems availability set out in the NER, and to avoid the impacts of taking primary assets out of service. Consequently, it is considered a reliability corrective action under the RIT-T.

A reliability corrective action differs from a 'market benefits'-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation on the network business.

No submissions received in response to Project Specification Consultation Report

TransGrid published a Project Specification Consultation Report (PSCR) on 22 October 2020 and invited written submissions on the material presented within the document. No submissions were received in response to the PSCR.

No material developments since publication of the PSCR

No additional credible options were identified during the consultation period following publication of the PSCR.

The following changes have occurred since the PSCR which have not made an impact on the preferred option:

- > updated the discount rates used
- > updated the inflation escalation
- > the cost estimate factors for Option 1 have been adjusted to reflect the latest estimated resourcing requirements to implement the preferred option. This resulted in an increase to the total cost estimate from \$4.4m to \$4.8m.

No other changes have occurred since the PSCR which have made an impact on the preferred option.

Option 1 remains the preferred option at this stage of the RIT-T process.

Complete in-situ replacement remains the most prudent and economically efficient option to meet regulatory obligations

In the PSCR TransGrid put forward for consideration three technically and commercially feasible options:

- > **Option 1** – Complete in-situ replacement
- > **Option 2** – Strategic asset replacement ; and

> **Option 3 – IEC-61850 replacement⁴**

Option 1 remains the most prudent and economically efficient option to address the identified need. Implementation of Option 1 will enable TransGrid to continue meeting its regulatory obligations set out in clauses 4.11.1, 4.6.1(b),⁵ and Schedule 5.1 of the NER. Consequently, it will ensure the performance standards applicable to Liverpool substation secondary systems are met and is therefore the preferred option for this RIT-T.

TransGrid expects coronavirus (COVID-19) to impact its suppliers and disrupt their supply chains. At this time the extent of the current or future impact is unknown. Consequently, some of the costs associated with the works outlined in this document may be affected.

All costs presented in this PACR are in 2020/21 dollars. The options are summarised in the table below.

Table 1 Options considered

Option	Description	Capital cost (\$m 2020/21)	Operating costs (\$ per year)	Remarks
Option 1	Complete in-situ replacement	~ 4.8 (+/- 25%)	~ 3,000	Preferred option, would maintain regulatory obligations and provide highest net economic benefits.
Option 2	Strategic asset replacement	~3.1 (+/- 25%) by 2022/23 and ~2.6 (+/- 25%) spread between 2024/25 and 2032/33	~ 3,000	Would maintain regulatory obligations but provide less net benefits
Option 3	IEC-61850 replacement ⁶	~ 10.2 (+/- 25%)	~ 10,000	

Non-network options are not able to assist in this RIT-T

In the PSCR, TransGrid noted that non-network options are not considered to be commercially and technically feasible to assist with meeting the identified need for this RIT-T. This is because non-network options will not

⁴ International Electrotechnical Commission (IEC), "IEC 61850 standard for Power Utility Automation," accessed 14 May 2020. <http://www.iec.ch/smartgrid/standards/>

⁵ As per clause 4.6.1(b) of the NER, AEMO must ensure that there are processes in place, which will allow the determination of fault levels for normal operation of the power system and in anticipation of all credible contingency events and protected events that AEMO considers may affect the configuration of the power system, so that AEMO can identify any busbar which could potentially be exposed to a fault level which exceeds the fault current ratings of the circuit breakers associated with that busbar.

⁶ International Electrotechnical Commission (IEC), "IEC 61850 standard for Power Utility Automation," accessed 14 May 2020. <http://www.iec.ch/smartgrid/standards/>

enable TransGrid to continue meeting its NER obligation to provide redundant secondary systems and ensure that the transmission system is adequately protected.

Conclusion: complete in-situ replacement of protection and control systems is optimal

The optimal commercially and technically feasible option presented in the PSCR – Option 1 (complete in-situ replacement of protection and control systems) – remains the preferred option to meet the identified need. Option 1 can be implemented in sufficient time to meet the identified need by 2022/23, and is therefore the preferred option presented in this PACR.

Moving forward with this option is the most prudent and economically efficient solution to enable TransGrid to continue meeting its regulatory obligations set out in clauses 4.11.1, 4.6.1(b),⁷ and Schedule 5.1 of the NER. Consequently, it will ensure the performance standards applicable to Liverpool substation secondary systems are met.

Option 1 involves replacement of all secondary systems assets at Liverpool substation. This option will modernise the automation philosophy to current design standards and practices. This option also includes replacement of Direct Current (DC) supplies to account for an increase in secondary systems power requirements and remediation of the 415V Alternating Current (AC) distribution in the building.

There are also additional operational benefits available due to improved remote monitoring, control and interrogation, efficiency gains in responding to faults, and phasing out of obsolete and legacy systems and protocols.

The estimated capital cost of this option is approximately \$4.8 million. Routine and operating maintenance costs are approximately \$3,000 per year.

The works will be undertaken between 2020/21 and 2022/23. Planning (including commencement of the RIT-T) commenced in 2019/20 and is due to conclude in 2021/22. The procurement and delivery of the identified assets is planned to occur during 2021/22. All works will be completed by 2022/23.

Necessary outages of relevant assets in service will be planned appropriately in order to complete the works with minimal impact on the network.

The analysis undertaken and the identification of Option 1 as the preferred option satisfies the RIT-T. Option 1 is the preferred option in accordance with NER clause 5.16.1(b) because it is the credible option that maximises the net present value of the net economic benefit to all those who produce, consume and transport electricity in the market. This preferred option, Option 1, was found to have the highest net economic benefit while also maintaining compliance with regulatory and safety obligations. TransGrid also conducted sensitivity analysis on the net economic benefit to investigate the robustness of the conclusion to key assumptions. TransGrid finds that under all sensitivities, except the low benefit scenario where the difference is marginal, Option 1 delivers the most net benefit. TransGrid notes that this scenario comprises an extreme combination of assumptions, including high capex costs and low operational risk.

⁷ As per clause 4.6.1(b) of the NER, AEMO must ensure that there are processes in place, which will allow the determination of fault levels for normal operation of the power system and in anticipation of all credible contingency events and protected events that AEMO considers may affect the configuration of the power system, so that AEMO can identify any busbar which could potentially be exposed to a fault level which exceeds the fault current ratings of the circuit breakers associated with that busbar.

Next steps

This PACR represents the third and final step of the consultation process in relation to the application of the Regulatory Investment Test for Transmission (RIT-T) process undertaken by TransGrid. It follows a Project Specification Consultation Report (PSCR) released in October 2020. No submissions were received in response to the PSCR.

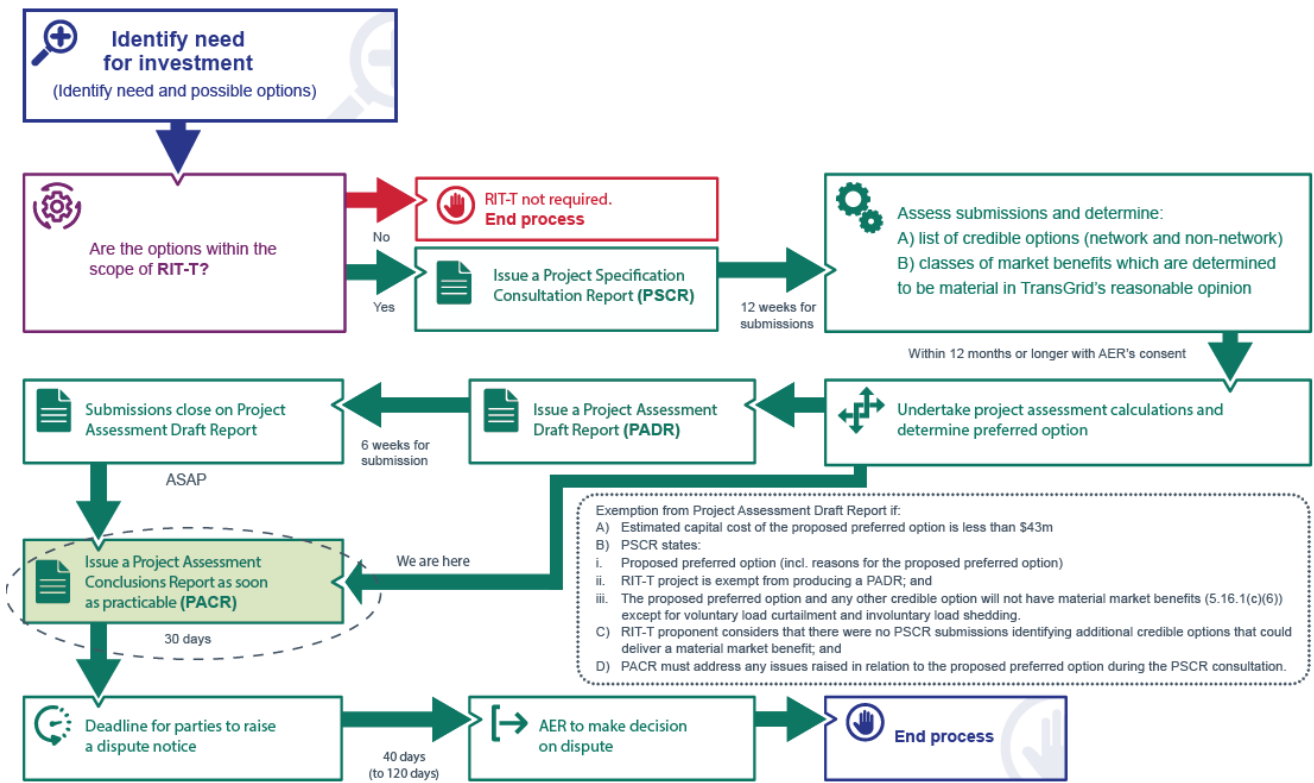
The second step, production of a Project Assessment Draft Report (PADR), was not required as TransGrid considers its investment in relation to the preferred option to be exempt from that part of the RIT-T process under NER clause 5.16.4(z1). Production of a PADR is not required⁸ due to:

- > the estimated capital cost of the proposed preferred option being less than \$43 million;
- > the PSCR stating:
 - the proposed preferred option (including reasons for the proposed preferred option)
 - the RIT-T is exempt from producing a PADR
 - the proposed preferred option and any other credible option will not have material market benefits⁹ except for voluntary load curtailment and involuntary load shedding
- > the RIT-T proponent considers that there were no PSCR submissions identifying additional credible options that could deliver a material market benefit; and
- > the PACR addressing any issues raised in relation to the proposed preferred option during the PSCR consultation.

⁸ In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if TransGrid considers that an additional credible option that could deliver a material market benefit is identified during the consultation period. No additional credible options were identified.

⁹ As per clause 5.16.1(c)(6)

Figure 1 This PACR is the third stage of the RIT-T process¹⁰



Parties wishing to raise a dispute notice with the AER may do so prior to 18 October 2021(30 days after publication of this PACR). Any dispute notices raised during this period¹¹ will be addressed by the AER within 40 to 120 days, after which the formal RIT-T process will conclude.

Further details on the RIT-T can be obtained from TransGrid’s Regulation team via RIT-TConsultations@transgrid.com.au. In the subject field, please reference ‘Liverpool Secondary Systems PACR’.

To read the full Project Assessment Conclusions Report visit the [Regulatory Investments Test page](#) on TransGrid’s website.

¹⁰ Australian Energy Market Commission. “Replacement expenditure planning arrangements, Rule determination”. Sydney: AEMC, 18 July 2017.65. Accessed 19 November 2019. <https://www.aemc.gov.au/sites/default/files/content/89fbf559-2275-4672-b6ef-c2574eb7ce05/Final-rule-determination.pdf>

¹¹ Additional days have been included to cover public holidays.